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**Okura**

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(54) **IMAGE FORMING APPARATUS**

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(73) Assignee: **KYOCERA Document Solutions Inc.** (JP)

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(51) **Int. Cl.**

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| ***B65H 1/26*** | (2006.01) |
| ***H05K 5/02*** | (2006.01) |
| ***G03G 15/00*** | (2006.01) |

(52) **U.S. Cl.**

CPC ..... ***B65H 1/04*** (2013.01); ***B65H 1/266*** (2013.01); ***G03G 15/6514*** (2013.01); ***H05K 5/0217*** (2013.01); *B65H 2402/31* (2013.01); *G03G 2215/00392* (2013.01)

(58) **Field of Classification Search**

CPC .. B65H 1/04; B65H 2402/31; B65H 2402/32; B65H 2402/35; B65H 2402/441; B65H 2402/442; B65H 2402/45; B65H 2402/521; G03G 15/6514; G03G 2215/00392; H05K 5/0221

See application file for complete search history.

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(57) **ABSTRACT**

An image forming apparatus includes an apparatus main body, an image forming unit, a tray unit and an attaching portion. The tray unit includes a pivot portion. The sheet is placed on the tray unit in an open state. The tray unit is capable of making a sliding movement in an axial direction of the pivot portion in a closed state. The tray unit is attached to the attaching portion in the closed state. The tray unit includes a pair of hooks that project from opposite end parts in the axial direction and each includes a projection. The attaching portion includes a pair of openings and a pair of engaging portions. The projections are inserted into the opening. Engaged positions of the projections with the engaging portions are variable according to the sliding movement in the closed state of the tray unit.

**6 Claims, 14 Drawing Sheets**

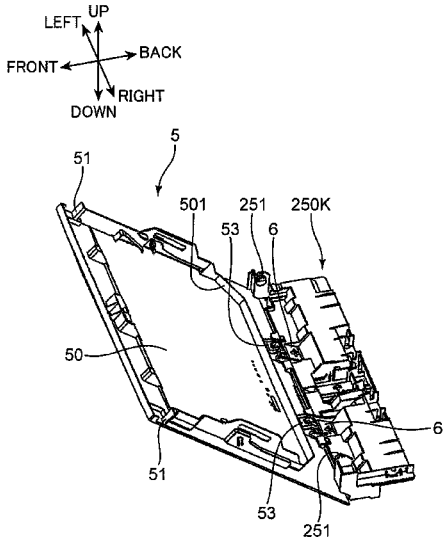


FIG. 1

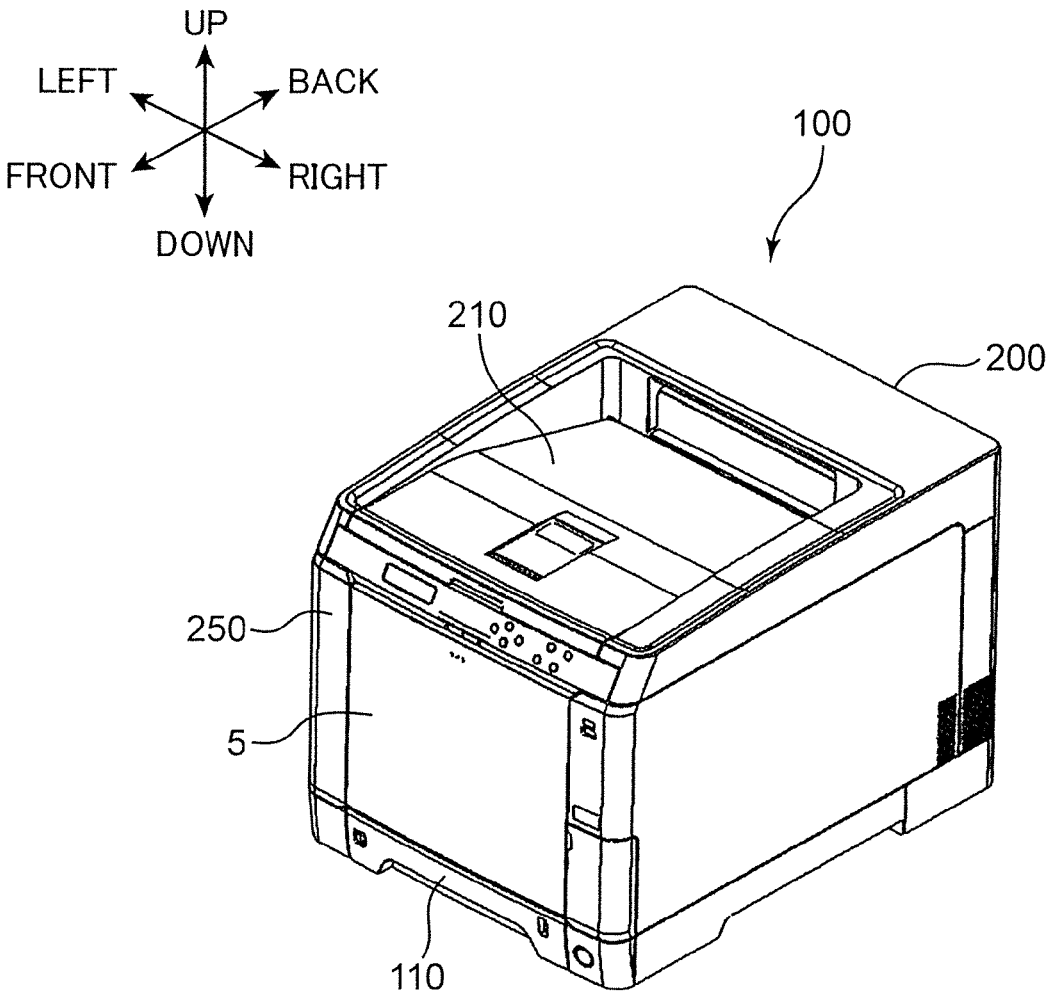


FIG. 2

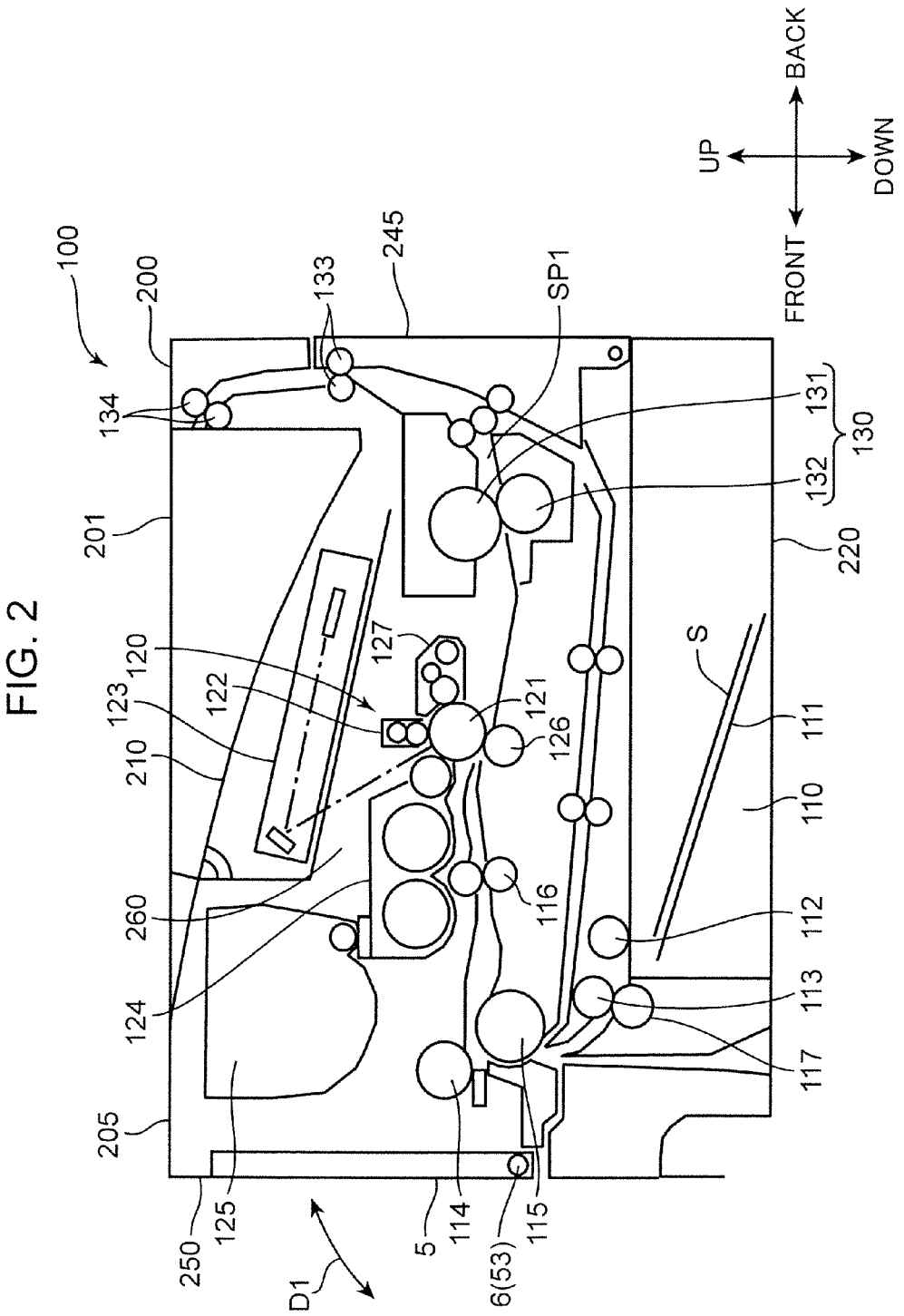

UP
BACK
DOWN
FRONT
100
200
133
245
SP1
134
131
130
132
201
220
120
127
S
122
121
123
126
111
210
110
116
260
112
124
113
117
205
250
125
D1
5
114
6(53)
115

FIG. 3

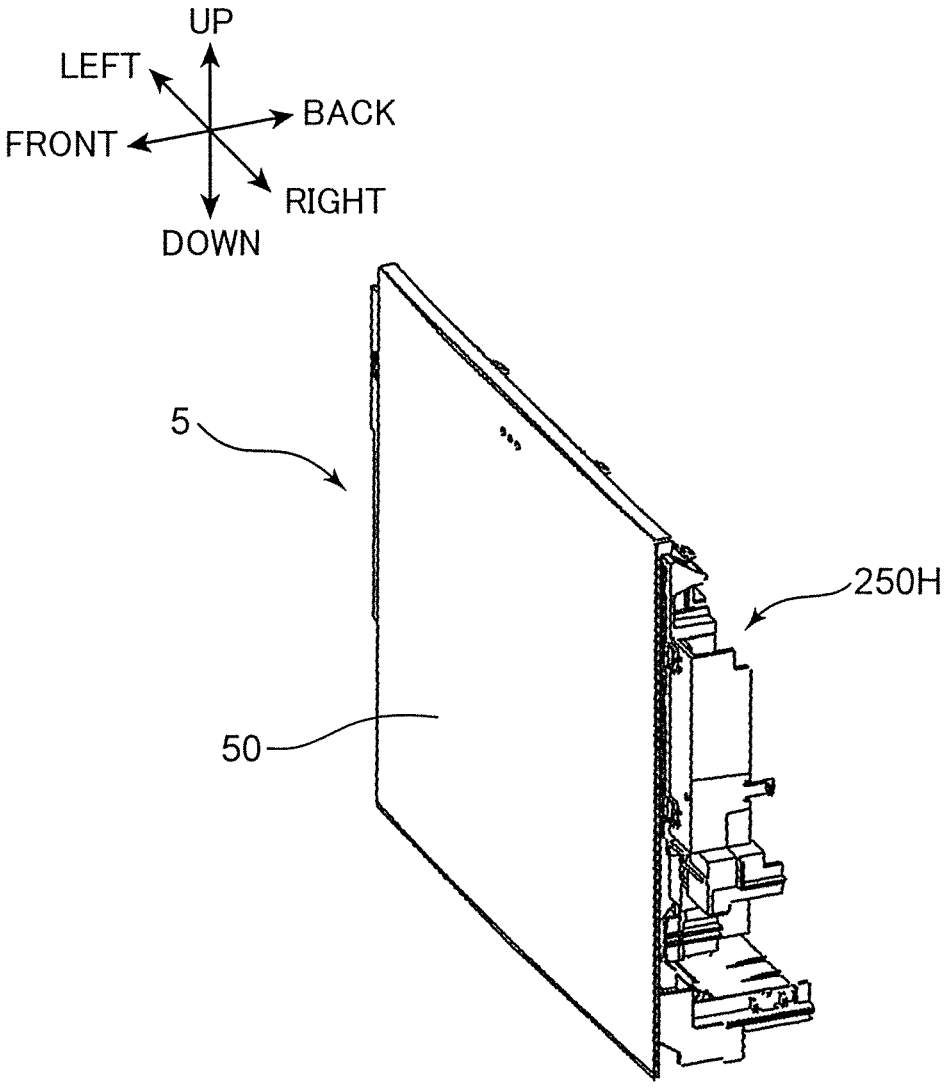
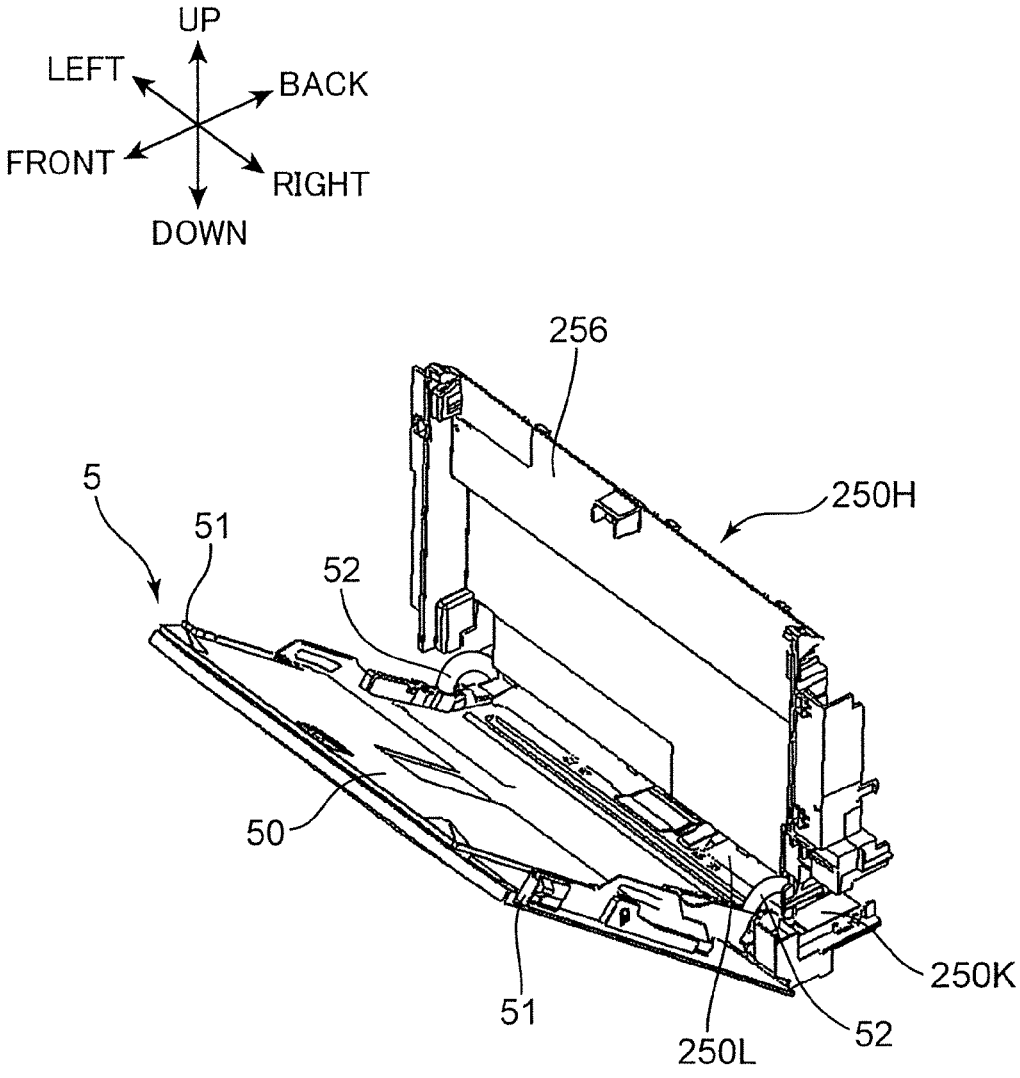


FIG. 4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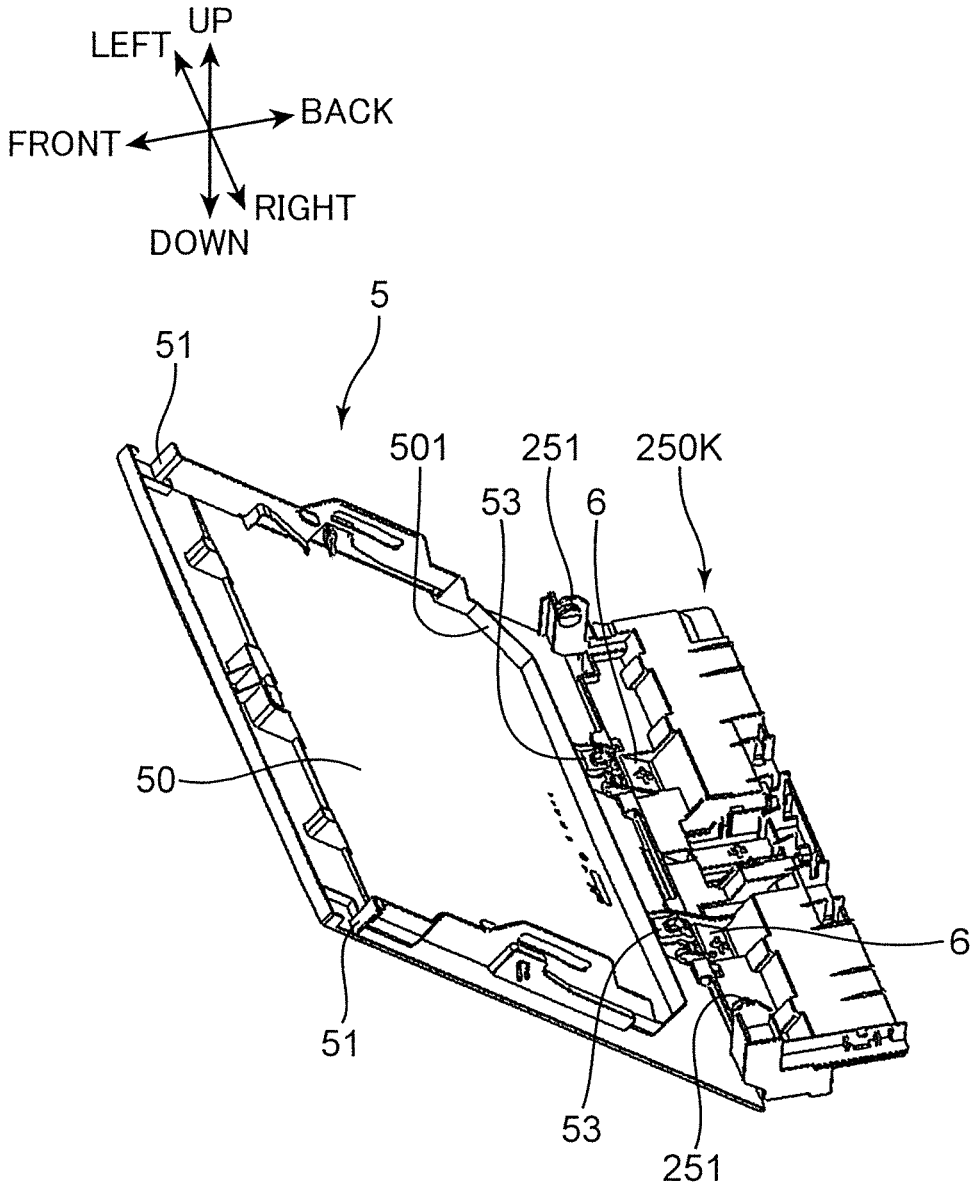
FRONT
RIGHT
DOWN
256
5
51
52
250H
50
51
250K
250L
52

FIG. 5


UP
LEFT
BACK
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5
51
501
251
250K
53
6
50
6
51
53
251

FIG. 6

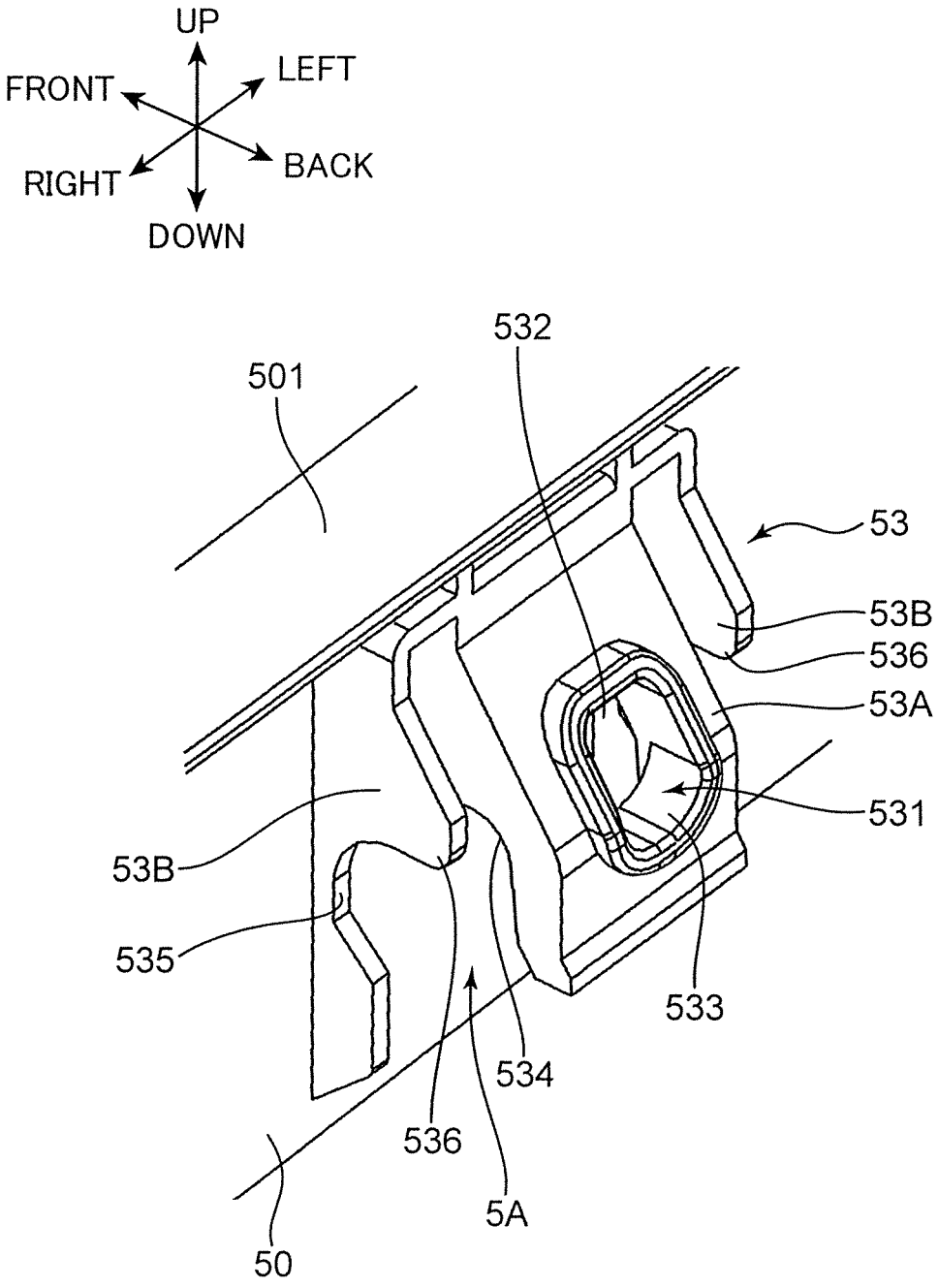

UP
FRONT
LEFT
RIGHT
BACK
DOWN
532
501
53
53B
536
53A
531
53B
535
533
534
536
5A
50

FIG. 7

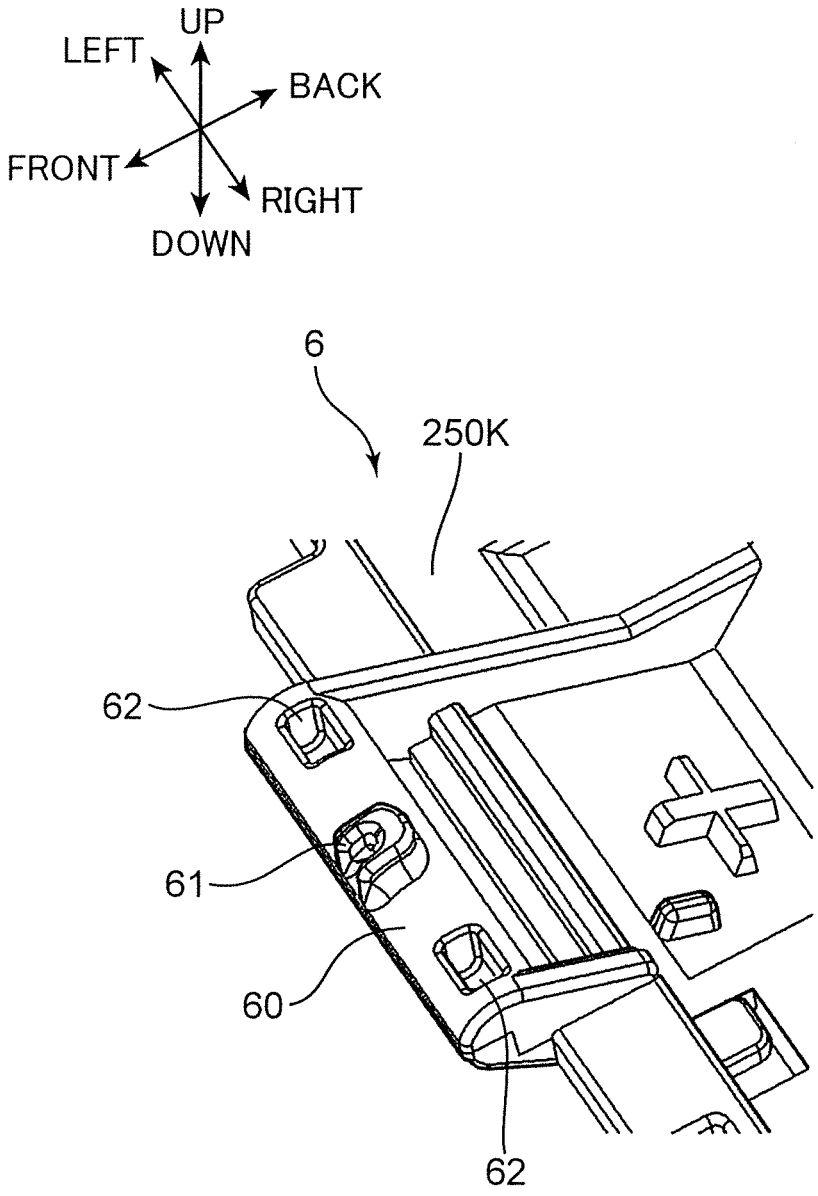
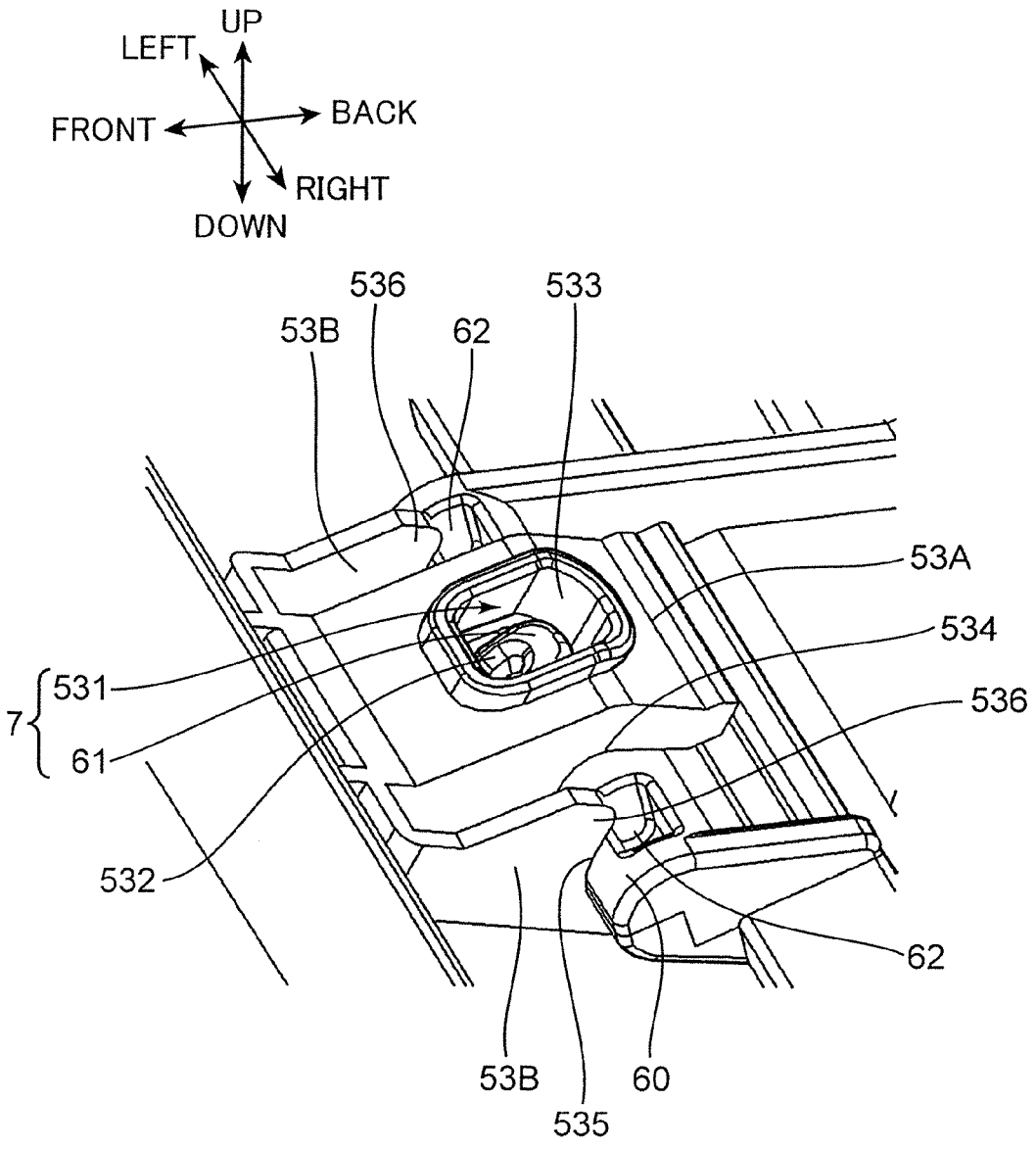


FIG. 8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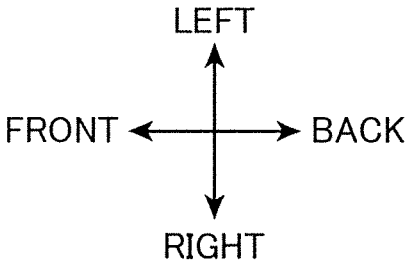
LEFT
FRONT
BACK
RIGHT
DOWN
536
533
53B
62
53A
534
531
7
61
536
532
62
53B
60
535

FIG. 9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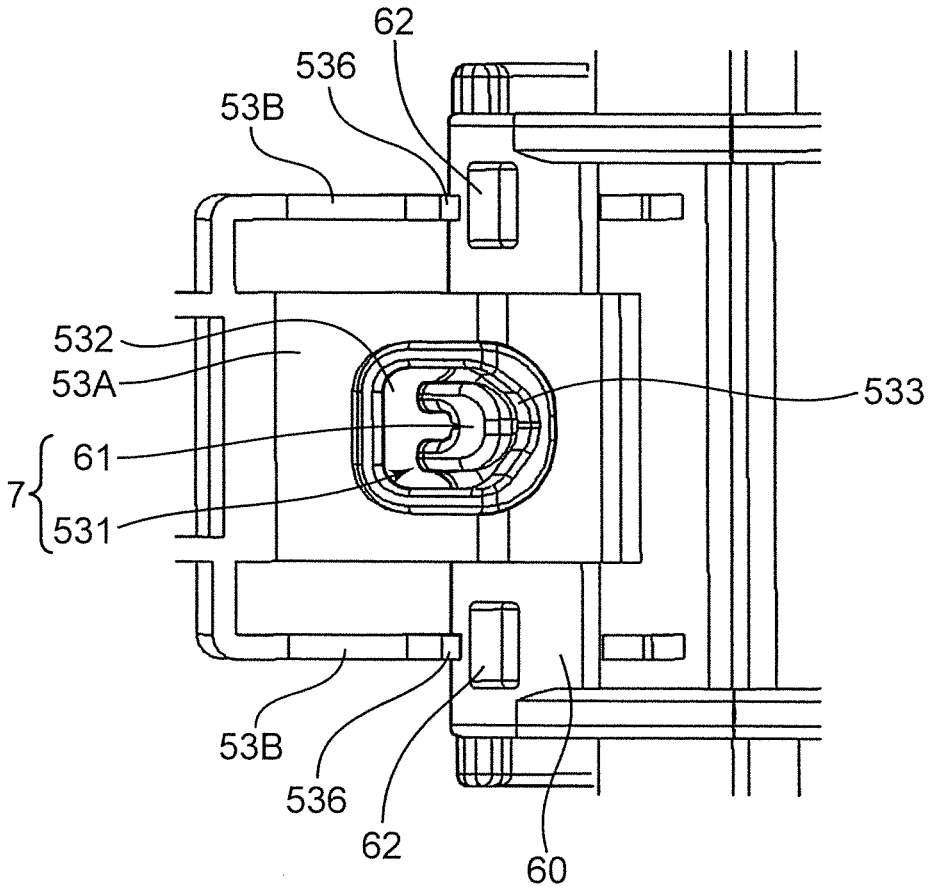
BACK
RIGHT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536
53B
532
53A
533
7
61
531
53B
536
62
60

FIG. 10A

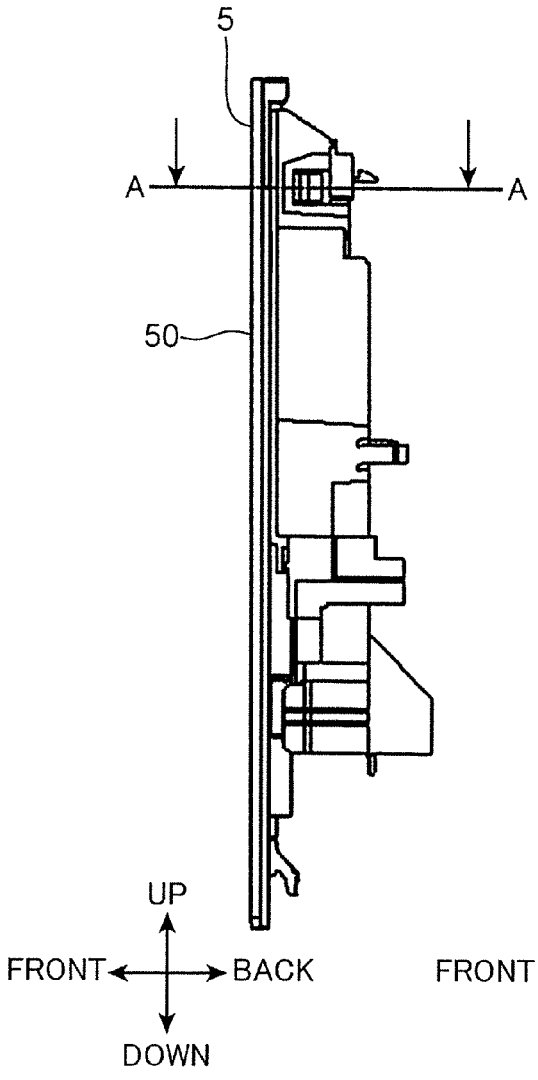



FIG. 10B

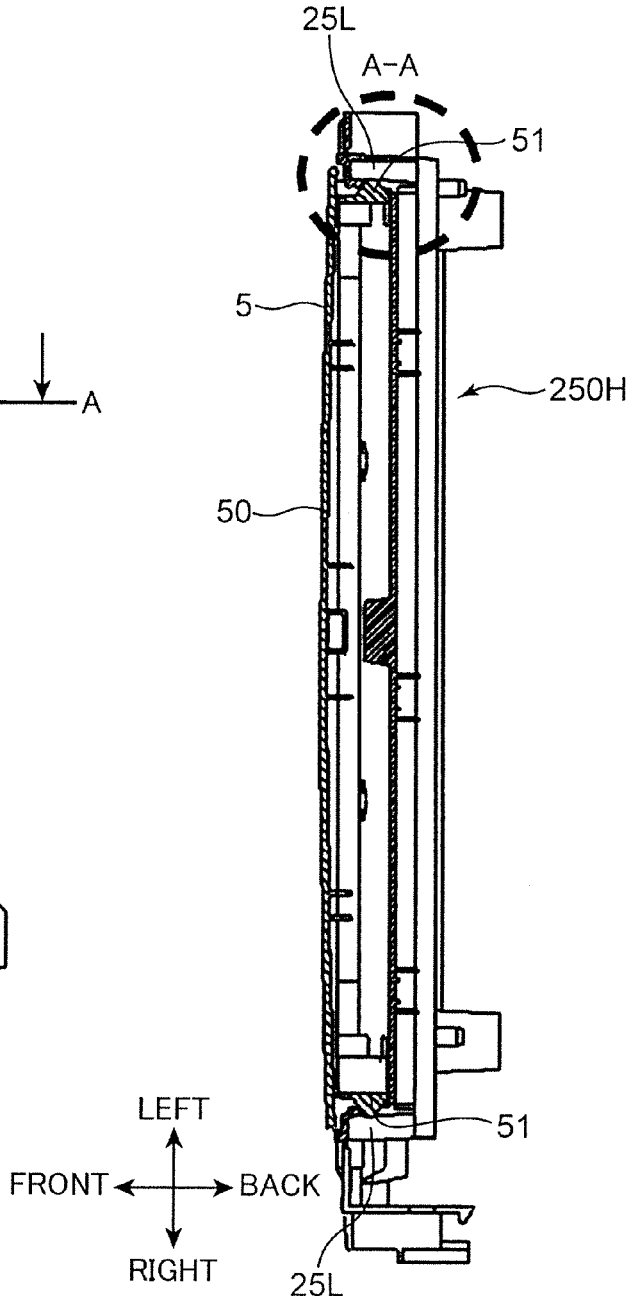
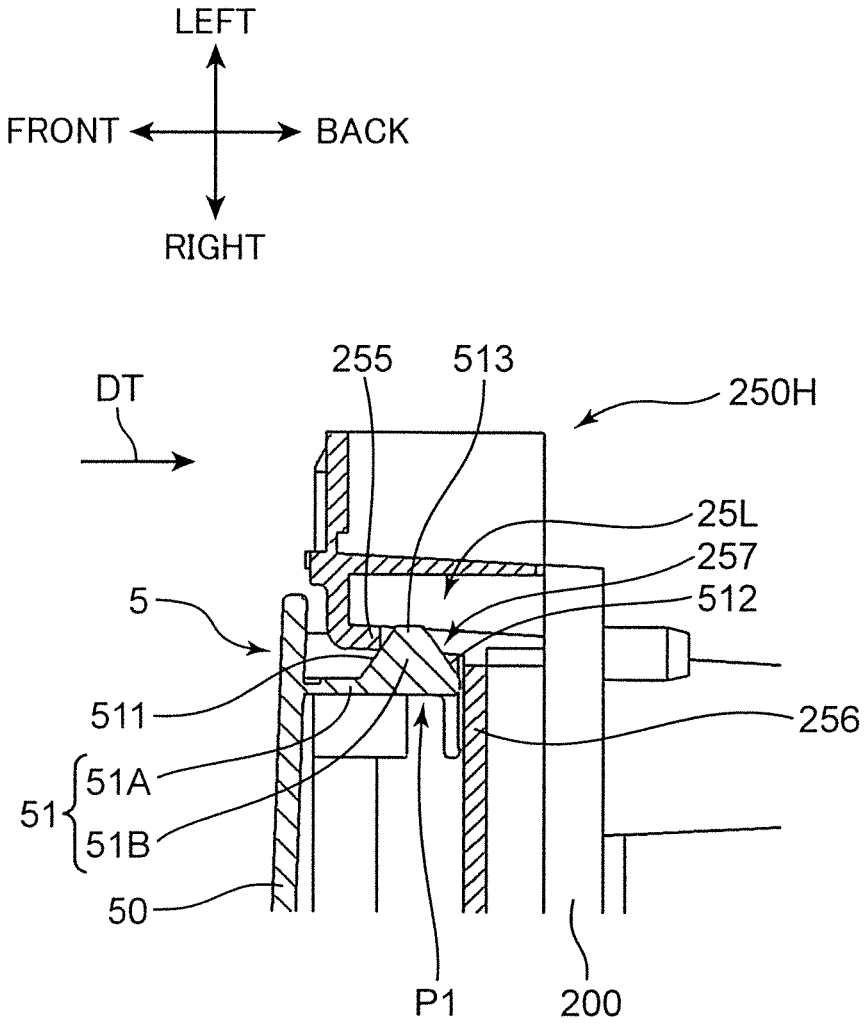


FIG. 11


LEFT
FRONT
BACK
RIGHT
DT
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513
250H
25L
257
512
5
511
256
51
51A
51B
50
P1
200

FIG. 12

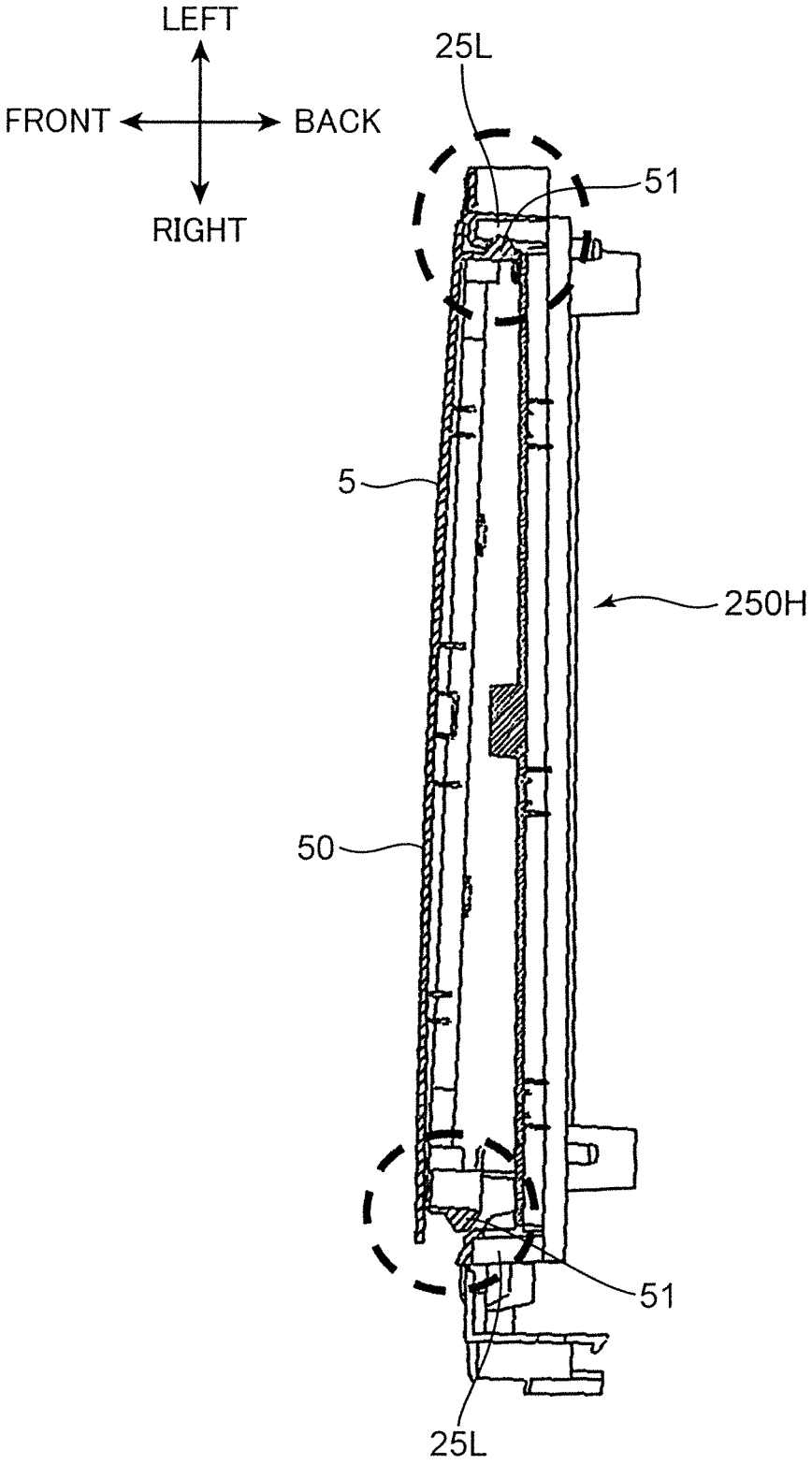
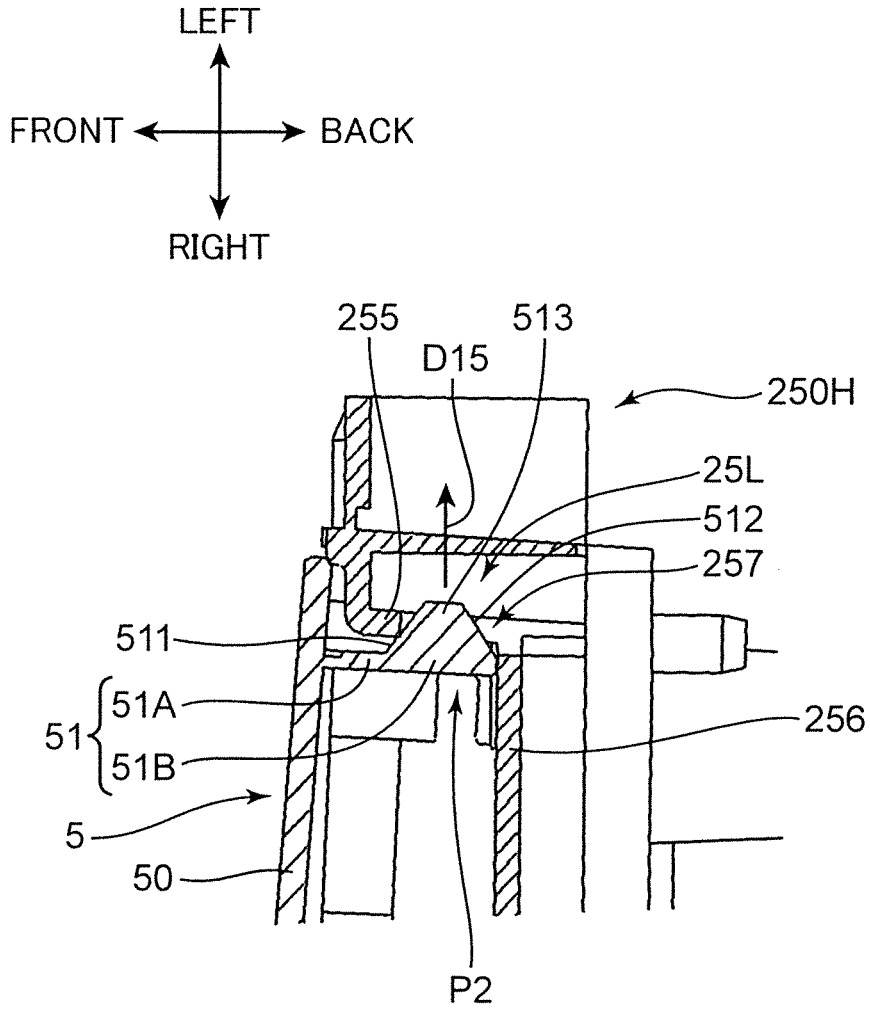


FIG. 13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FRONT
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25L
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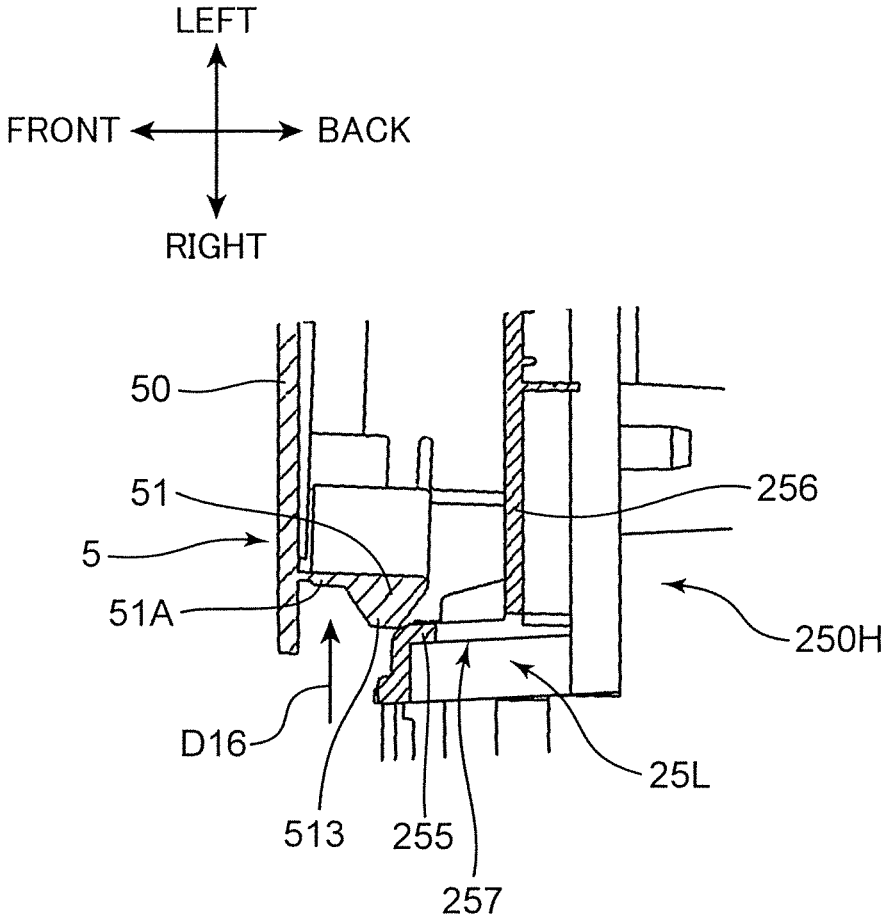
257
511
51
51A
51B
256
5
50
P2

FIG. 14



# IMAGE FORMING APPARATUS

## INCORPORATION BY REFERENCE

This application is based on Japanese Patent Application No. 2013-234998 filed with the Japan Patent Office on Nov. 13, 2013, the contents of which are hereby incorporated by reference.

## BACKGROUND

The present disclosure relates to an image forming apparatus for forming an image on a sheet.

Conventionally, an image forming apparatus for forming an image on a sheet includes a sheet feeding unit, an image forming unit and a sheet discharging portion. An image is formed on a surface of a sheet fed from the sheet feeding unit in the image forming unit. Thereafter, the sheet is discharged to the sheet discharging portion provided on an apparatus main body of the image forming apparatus. Further, some image forming apparatuses are known to include a manual feed tray. The manual feed tray is openable with respect to the apparatus main body and a sheet is placed thereon in an open state.

There is also known a technology with a manual feed tray withdrawable from an apparatus main body of an image forming apparatus and a lid member coupled to the manual feed tray and openable with respect to the apparatus main body.

In such a technology, the openable lid member includes a pair of hook members to be engaged with the apparatus main body and spaced apart in a sheet width direction.

## SUMMARY

An image forming apparatus according to one aspect of the present disclosure includes an apparatus main body, an image forming unit, a tray unit and an attaching portion. The image forming unit is arranged in the apparatus main body and forms an image on a sheet. The tray unit includes a pivot portion on a lower end part. The tray unit is openable with respect to the apparatus main body by being rotated about the pivot portion. The sheet is placed on an upper surface of the tray unit in an open state with respect to the apparatus main body. The tray unit is capable of making a sliding movement in an axial direction of the pivot portion in a closed state with respect to the apparatus main body. The attaching portion is arranged on the apparatus main body and the tray unit is attached thereto in the closed state. The tray unit includes a pair of hooks. The hooks project from opposite end parts in the axial direction toward the apparatus main body and each includes a base end portion and a projection projecting toward an axially outer side on a tip part of the base end portion. The attaching portion includes a pair of openings and a pair of engaging portions. The projections are inserted into the openings toward the axially outer sides. The engaging portions define parts of the openings and the projections are engaged therewith. Engaged positions of the projections with the engaging portions in the axial direction are variable according to the sliding movement in the closed state of the tray unit.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view showing the external appearance of an image forming apparatus according to one embodiment of the present disclosure,



FIG. **2** is a sectional view schematically showing the internal structure of the image forming apparatus according to the one embodiment of the present disclosure,

FIG. **3** is a perspective view of a manual feed tray according to the one embodiment of the present disclosure,

FIG. **4** is a perspective view showing a state where the manual feed tray according to the one embodiment of the present disclosure is opened,

FIG. **5** is a perspective view showing a state where the manual feed tray according to the one embodiment of the present disclosure is opened,

FIG. **6** is an enlarged perspective view enlargedly showing a part of the manual feed tray according to the one embodiment of the present disclosure,

FIG. **7** is an enlarged perspective view enlargedly showing a part of an apparatus main body of the image forming apparatus according to the one embodiment of the present disclosure,

FIG. **8** is an enlarged perspective view showing a coupled state of the manual feed tray and the apparatus main body according to the one embodiment of the present disclosure,

FIG. **9** is a plan view showing the coupled state of the manual feed tray and the apparatus main body of FIG. **8**,

FIG. **10**A is a side view showing a state where the manual feed tray according to the one embodiment of the present disclosure is properly fixed to the apparatus main body and FIG. **10**B is a sectional view showing the state where the manual feed tray according to the one embodiment of the present disclosure is properly fixed to the apparatus main body,

FIG. **11** is an enlarged sectional view enlargedly showing a part of FIG. **10**B,

FIG. **12** is a sectional view showing a state where the manual feed tray according to the one embodiment of the present disclosure is in a one-sided closed state with respect to the apparatus main body,

FIG. **13** is an enlarged sectional view enlargedly showing a part of FIG. **12**,

FIG. **14** is an enlarged sectional view enlargedly showing a part of FIG. **12**.

## DETAILED DESCRIPTION

Hereinafter, one embodiment of the present disclosure is described with reference to the drawings. FIG. **1** is a perspective view of a printer **100** (image forming apparatus) according to one embodiment of the present disclosure. FIG. **2** is a sectional view schematically showing the internal structure of the printer **100**. Although the printer **100** shown in FIGS. **1** and **2** is a so-called monochrome printer, the image forming apparatus may be a color printer, a facsimile machine, a complex machine provided with these functions or another apparatus for forming a toner image on a sheet in another embodiment. Note that direction-indicating terms such as "upper" and "lower", "front" and "rear", "left" and "right" used in the following description are merely for the purpose of clarifying the description and do not limit the principle of the image forming apparatus at all.

The printer **100** is provided with a housing **200** (apparatus main body) for housing various devices for forming an image on a sheet S. The housing **200** includes an upper wall **201** defining the upper surface of the housing **200**, a bottom wall **220** (FIG. **2**) defining the bottom surface of the housing **200**, a back wall **245** (FIG. **2**) between the upper wall **201** and the bottom wall **220** and a front wall **250** located in front of the

back wall **245**. The housing **200** has a main body internal space **260** (internal space) in which various devices are arranged.

A sheet discharging portion **210** is arranged in a central part of the upper wall **201**. The sheet discharging portion **210** is formed by an inclined surface inclined downwardly from a front part to a rear part of the upper wall **201**. A sheet S having an image formed thereon in an image forming unit **120** to be described later is discharged to the sheet discharging portion **210**.

Further, a manual feed tray **5** is arranged in a central part of the front wall **250**. The manual feed tray **5** is vertically rotatable (arrow D**1** of FIG. **2**) about a supporting shaft portion **6** (pivot portion) arranged on a lower end part, thereby being openable with respect to the housing **200**. Note that the manual feed tray **5** according to this embodiment is described in detail later.

The printer **100** includes a sheet conveyance path SP**1**, a cassette **110**, a pickup roller **112**, a first feed roller **113**, a retard roller **117**, a second feed roller **114**, a conveyor roller **115**, a pair of registration rollers **116** and the image forming unit **120**. The sheet conveyance path SP**1** is a conveyance path which is arranged in the housing **200** and in which a sheet S is conveyed in a predetermined direction.

Sheets S are stored in the cassette **110**. The cassette **110** includes a lift plate **111** for supporting the sheets S. The lift plate **111** is inclined to push up the leading edges of the sheet S. The cassette **110** defines a part of the front wall **250** of the housing **200** and withdrawable forward with respect to the housing **200**.

The pickup roller **112** is arranged above the leading edges of the sheets S pushed up by the lift plate **111**. When the pickup roller **112** rotates, the sheet S is pulled out of the cassette **110** and conveyed into the sheet conveyance path SP**1**.

The first feed roller **113** is arranged downstream of the pickup roller **112**. The first feed roller **113** feeds the sheet S to a further downstream side. The retard roller **117** deters a plurality of sheets S from being simultaneously fed by the first feed roller **113**. The second feed roller **114** is arranged at an inner side (rear side) of a pivot of the manual feed tray **5**. The second feed roller **114** pulls a sheet S on the manual feed tray **5** into the housing **200**. A user can selectively use the sheet S stored in the cassette **110** or the sheet S placed on the manual feed tray **5**.

The conveyor roller **115** is arranged downstream of the first feed roller **113** in a sheet conveying direction (hereinafter, also merely referred to as the "conveying direction"). Hereinafter, a downstream side may be mentioned without reference to the sheet conveying direction. The conveyor roller **115** is arranged to face the second feed roller **114** and conveys the sheet S fed by the first feed roller **113** to a further downstream side.

The pair of registration rollers **116** have a function of correcting the oblique feed of the sheet S. The position of an image formed on the sheet is adjusted by this. The pair of registration rollers **116** supply the sheet S to the image forming unit **120** in accordance with an image forming timing by the image forming unit **120**.

The image forming unit **120** is arranged in the housing **200** and forms a toner image on a sheet S. The image forming unit **120** includes a photoconductive drum **121**, a charger **122**, an exposure device **123**, a developing device **124**, a toner container **125**, a transfer roller **126** and a cleaning device **127**.

The photoconductive drum **121** has a cylindrical shape. The photoconductive drum **121** has an electrostatic latent image formed on a circumferential surface thereof and carries a toner image corresponding to the electrostatic latent image. A predetermined voltage is applied to the charger **122**, which substantially uniformly charges the circumferential surface of the photoconductive drum **121**.

The exposure device **123** irradiates laser light to the circumferential surface of the photoconductive drum **121** charged by the charger **122**. The laser light is irradiated in accordance with image data output from an external apparatus (not shown) such as a personal computer communicably connected to the printer **100**. As a result, an electrostatic latent image corresponding to the image data is formed on the circumferential surface of the photoconductive drum **121**.

The developing device **124** supplies toner to the circumferential surface of the photoconductive drum **121** on which an electrostatic latent image is formed. The toner container **125** supplies the toner to the developing device **124**. When the developing device **124** supplies the toner to the photoconductive drum **121**, the electrostatic latent image formed on the circumferential surface of the photoconductive drum **121** is developed (visualized). As a result, a toner image is formed on the circumferential surface of the photoconductive drum **121**.

The transfer roller **126** is rotatably arranged to come into contact with the circumferential surface of the photoconductive drum **121**. When a sheet S conveyed from the pair of registration rollers **116** passes between the photoconductive drum **121** and the transfer roller **126**, a toner image formed on the circumferential surface of the photoconductive drum **121** is transferred to the sheet S. Note that the transfer roller **126** is arranged at a side of the photoconductive drum **121** opposite to the exposure device **123**.

The cleaning device **127** removes the toner remaining on the circumferential surface of the photoconductive drum **121** after a toner image is transferred to a sheet S. The circumferential surface of the photoconductive drum **121** cleaned by the cleaning device **127** passes below the charger **122** again to be uniformly charged. Thereafter, the aforementioned toner image formation is performed anew.

The printer **100** further includes a fixing device **130** for applying a toner image fixing process to a sheet S at a side downstream of the image forming unit **120** in the conveying direction. The fixing device **130** includes a heating roller **131** for melting the toner on the sheet S and a pressure roller **132** for bringing the sheet S into close contact with the heating roller **131**. When the sheet S passes between the heating roller **131** and the pressure roller **132**, the toner image is fixed to the sheet S. The heating roller **131** is driven to rotate by an unillustrated drive mechanism. The pressure roller **132** is rotated, following the rotation of the heating roller **131**.

The printer **100** further includes a pair of conveyor rollers **133** arranged downstream of the fixing device **130** and a pair of discharge rollers **134** arranged downstream of the pair of conveyor rollers **133**. The sheet S is conveyed upwardly by the pair of conveyor rollers **133** and finally discharged from the housing **200** by the pair of discharge rollers **134**. Sheets S discharged from the housing **200** are stacked on the sheet discharging portion **210**.

Next, the structure of the manual feed tray **5** (tray unit) according to this embodiment is described in detail with reference to FIGS. **3** to **5** in addition to FIGS. **1** and **2**. FIG. **3** is a perspective view of the manual feed tray **5** according to this embodiment. Note that a closed state of the manual feed tray **5** with respect to the housing **200** is shown in FIG. **3** and a front frame **250**H as a part of the housing **200** is also shown. Further, FIGS. **4** and **5** are perspective views showing a state where the manual feed tray **5** according to this embodiment is open.

In an open state of the manual feed tray **5** with respect to the housing **200**, a sheet S is placed on the upper surface of the manual feed tray **5**. Further, the manual feed tray **5** is slidable in a sheet width direction (axial direction of the supporting shaft portion **6** to be described later, lateral direction) in the closed state with respect to the housing **200**.

With reference to FIGS. **4** and **5**, the manual feed tray **5** includes a tray main body **50**, hooks **51** (hook), link members **52** and bearing portions **53** (pivot portion).

The tray main body **50** is a main body part of the manual feed tray **5**. In the aforementioned open state of the manual feed tray **5**, a sheet S is placed on the tray main body **50**. A pair of hooks **51** are arranged on the manual feed tray **5**. The hooks **51** project toward the housing **200** from opposite end parts of the manual feed tray **5** in the axial direction. A projection **51**B (FIG. **11**) projecting outwardly in the axial direction is provided on a tip part of the hook **51**. Note that the structure of the hook **51** is described in detail later.

The link members **52** (FIG. **4**) are members arranged between the manual feed tray **5** and the front frame **250**H to be described later and linking the housing **200** and a divided unillustrated downstream tray (movable tray) of the manual feed tray **5**. The link members **52** restrict an opening angle of the manual feed tray **5**. A pair of the bearing portions **53** are arranged on a lower end part of the tray main body **50** of the manual feed tray **5**. Specifically, as shown in FIG. **5**, the bearing portions **53** are arranged on a lower part of a substantially U-shaped rib **501** arranged along the peripheral edge of the tray main body **50**. The bearing portions **53** are bearing portions to be externally fitted to the supporting shaft portion **6** to be described later and form a pivot portion for a rotational movement of the manual feed tray **5**.

With reference to FIGS. **3** and **4**, the housing **200** includes the front frame **250**H forming a part of the front wall **250**. The front frame **250**H is a resin frame standing on a front part of the housing **200**. In the closed state of the manual feed tray **5** with respect to the housing **200**, the manual feed tray **5** is attached to the front frame **250**H.

Next, the structure for coupling the manual feed tray **5** and the housing **200** is further described in detail with reference to FIGS. **6** to **9**. FIG. **6** is an enlarged perspective view enlargedly showing a part of the manual feed tray **5**. FIG. **7** is an enlarged perspective view enlargedly showing a part of a lower frame **250**K of FIG. **5**. FIG. **8** is an enlarged perspective view showing a coupled state of the manual feed tray **5** and the lower frame **250**K of the housing **200**. FIG. **9** is a plan view showing the coupled state of FIG. **8**.

With reference to FIG. **6**, each of the pair of bearing portions **53** includes a first member **53**A and second members **53**B.

The first member **53**A is arranged in a central part of the bearing portion **53** in the lateral direction. In the closed state of the manual feed tray **5** where the manual feed tray **5** vertically extends (FIG. **3**), the first member **53**A is a projecting piece projecting backward and downward from the lower part of the rib **501**. An engaging hole **531** is open on the first member **53**A. The engaging hole **531** is a long hole open on the first member **53**A along a circumferential direction of the rotation of the manual feed tray **5**. An engaging projection **61** is inserted into the engaging hole **531**. The engaging hole **531** includes a first supporting portion **532** and a second supporting portion **533**. The first supporting portion **532** corresponds to one circumferential end side of the engaging hole **531** and the second supporting portion **533** corresponds to the other circumferential end side of the engaging hole **531**. Further, the first member **53**A includes a first shaft supporting portion **534**. The first shaft supporting portion **534** is a peripheral surface formed in an area of the first member **53**A facing the tray main body **50**. The first shaft supporting portion **534** of the first member **53**A supports a circumferential part of a shaft portion **60** to be described later.

A pair of second members **53**B are arranged at opposite sides of the first member **53**A in the lateral direction (axial direction of the shaft portion **60** to be described later). The second member **53**B is a projecting piece projecting from the tray main body **50**. In the perspective view shown in FIG. **6**, a substantially triangular upper end part of the second member **53**B projects backward. An entering projection **536** is arranged on the tip of the upper end part. The entering projection **536** is inserted into a hole portion **62** to be described later. On the other hand, a trapezoidal lower end part of the second member **53**B projects with a height lower than the upper end part. A vertical central part of the second member **53**B is cut arcuately toward the tray main body **50**, thereby forming a second shaft supporting portion **535**. The second shaft supporting portion **535** of the second member **53**B comes into contact with a circumferential part of the shaft portion **60** to be described later, thereby supporting the shaft portion **60** together with the first shaft supporting portion **534** of the first member **53**A.

Further, the front frame **250**H includes the lower frame **250**K (FIG. **5**). The lower frame **250**K is a frame arranged on a lower side out of the front frame **250**H. As shown in FIG. **5**, the lower frame **250**K is a plate-like member extending in the lateral direction while having a predetermined width in the front-back direction. The lower frame **250**K is arranged to be connected to the tray main body **50** of the manual feed tray **5** in the open state. A sheet S placed on the manual feed tray **5** is carried into the housing **200** along an upper surface part of the lower frame **250**K. Note that, although not shown in FIG. **5**, a lift plate **250**L is arranged on the upper surface part of the lower frame **250**K as shown in FIG. **4**. The lift plate **250**L is rotatable to push up the leading end side of the sheet S placed on the manual feed tray **5**. At this time, an elevating plate pivot portion **251** (FIG. **5**) serves as a pivot of the rotation of the lift plate **250**L.

The lower frame **250**K includes supporting shaft portions **6** (FIG. **7**). A pair of the supporting shaft portions **6** are arranged on the front end edge of the lower frame **250**K. The supporting shaft portion **6** projects forward from this end edge. With reference to FIG. **7**, the supporting shaft portion **6** includes the shaft portion **60**, the engaging projection **61** and the hole portion **62**. The shaft portion **60** is arranged on a front end part of the supporting shaft portion **6**. A front part of the shaft portion **60** has an arcuate shape. The shaft portion **60** extends in a direction of an axis of the rotation of the manual feed tray **5** (lateral direction) and serves as a rotary shaft in the rotation of the manual feed tray **5**. The shaft portion **60** is mounted into the bearing portion **53** of the manual feed tray **5**. The engaging projection **61** projects upwardly from a lateral central part of the shaft portion **60**. The engaging projection **61** is a substantially U-shaped projection.

Note that the engaging projection **61** of the supporting shaft portion **6** and the engaging hole **531** of the bearing portion **53** of the manual feed tray **5** function as a restricting portion **7** (FIG. **8**). The restricting portion **7** restricts the position of the manual feed tray **5** in the axial direction in the open state of the manual feed tray **5** with respect to the housing **200**.

Next, a rotational movement of the manual feed tray **5** about the bearing portions **53** and the supporting shaft portions **6** is described. When the bearing portion **53** shown in FIG. **6** is viewed in a cross-section (not shown) intersecting with the lateral direction, a space between the first member

53A and the second members 53B is partly open in the circumferential direction (open area 5A, see FIG. 6). In FIG. 6, lower part between the first member 53A and the second members 53B is open. When the manual feed tray 5 is attached to the lower frame 250K of the housing 200, the bearing portions 53 are attached to the shaft portions 60 of the supporting shaft portions 6 via the open area 5A. As a result, as shown in FIG. 8, the shaft portion 60 of the supporting shaft portion 6 is fitted between the first shaft supporting portion 534 of the first member 53A and the second shaft supporting portions 535 of the pair of second members 53B. The manual feed tray 5 is rotatable about the shaft portions 60 with respect to the housing 200. At this time, the engaging projections 61 projecting from the shaft portions 60 are inserted into the engaging holes 531 open on the first members 53A.

In this embodiment, an opening width of the first supporting portion 532 of the engaging hole 531 in the axial direction (lateral direction) is set wider than the width of the engaging projection 61 in the axial direction. On the other hand, an opening width of the second supporting portion 533 of the engaging hole 531 in the axial direction is set substantially equal to the width of the engaging projection 61 in the axial direction. In other words, in a top view shown in FIG. 9, a part of the engaging hole 531 on the side of the second supporting portion 533 is tapered to have a narrower opening width toward the back. At this time, since the second supporting portion 533 is inclined toward the center, the engaging projection 61 can be positioned in the center of the engaging hole 531.

As the manual feed tray 5 is opened and closed with respect to the housing 200, the engaging holes 531 of the first members 53A move in the circumferential direction with respect to the engaging projections 61. In the closed state of the manual feed tray 5 shown in FIG. 3, the engaging projections 61 are arranged on the side of the first supporting portions 532 of the engaging holes 531. At this time, predetermined clearances are formed in the axial direction between inner wall parts of the first members 53A defining the first supporting portions 532 and the engaging projections 61. Thus, in the closed state of the manual feed tray 5, the manual feed tray 5 is slidable by a predetermined distance in the lateral direction with respect to the housing 200.

On the other hand, when the manual feed tray 5 is opened and set in the open state shown in FIG. 5, the engaging projections 61 are fitted into the second supporting portions 533 of the engaging holes 531 as shown in FIG. 9. Note that the engaging projections 61 are guided to the inclined surfaces of the second supporting portions 533 while moving toward the second supporting portions 533 when the manual feed tray 5 is opened. As a result, the engaging projections 61 are positioned at center positions of the engaging holes 531 as described above. As a result, the position of the manual feed tray 5 in the axial direction (lateral direction) is restricted. In the open state of the manual feed tray 5, the lateral position of a sheet S placed on the tray main body 50 of the manual feed tray 5 needs to be restricted. This is because, if the position of the sheet S varies, the posture of the sheet S carried into the housing 200 varies to cause a sheet jam or the like. In this embodiment, troubles such as the sheet jam are prevented since the position of the manual feed tray 5 is stably maintained as described above in a state where the sheet S is placed. Further, an image position deviation caused by a feeding position deviation of the sheet S can be prevented.

Next, a structure for fixing the manual feed tray 5 to the housing 200 is described in detail with reference to FIGS. 10A to 14. FIG. 10A is a side view showing a state where the manual feed tray 5 according to this embodiment is properly fixed to the housing 200, and FIG. 10B is a sectional view along a line A-A of FIG. 10A showing the state where the manual feed tray 5 according to this embodiment is properly fixed to the housing 200. Further, FIG. 11 is an enlarged sectional view enlargedly showing a part (area enclosed by broken line) of FIG. 10B. FIG. 12 is a sectional view showing a state where the manual feed tray 5 according to this embodiment is fixed in a one-sided closed state to the housing 200. FIGS. 13 and 14 are enlarged sectional views enlargedly showing parts (areas enclosed by broken line) of FIG. 12.

With reference to FIG. 11, the hook 51 includes a base end portion 51A and the projection 51B. The base end portion 51A is a base end part of the hook 51 and projects from the tray main body 50 of the manual feed tray 5 toward the front frame 250H. The projection 51B is arranged on a tip side of the base end portion 51A and projects laterally outwardly of the manual feed tray 5. As shown in FIG. 11, in a cross-section along the axial direction of the shaft portion 60 (FIG. 8) (cross-section including the front-back direction and the lateral direction), the projection 51B has a substantially triangular shape. The projection 51B has a first slant 511, a second slant 512 and a top portion 513. The first slant 511 is an inclined surface inclined axially outwardly (toward an opening 257 to be described later, from the base end portion 51A toward the top portion 513 to be described later) along an closing direction of the manual feed tray 5 toward the housing 200 (direction of an arrow DT of FIG. 11). The first slant 511 is arranged on a rear end side in the closing direction. The first slant 511 is connected to the base end portion 51A. Further, the second slant 512 is an inclined surface arranged on a lead end side in the closing direction and inclined axially inwardly (away from the opening 257 to be described later, from the top portion 513 to be described later toward the base end portion 51A) along the closing direction. The top portion 513 is arranged between the first and second slants 511, 512, corresponds to a top part of the projection 51B and projects from the base end portion 51A toward the opening 257 to be described later. The top portion 513 is a flat surface portion extending along the front-back direction.

On the other hand, the front frame 250H includes fixing portions 25L (FIG. 11). A pair of the fixing portions 25L are arranged to correspond to the pair of hooks 51 of the manual feed tray 5. The hooks 51 are respectively fixed to the pair of fixing portions 25L. The fixing portion 25L includes the opening 257 and a contact portion 255 (engaging portion). Further, the front frame 250H includes a facing plate 256. The facing plate 256 is a standing wall portion of the front frame 250H facing the tray main body 50.

The openings 257 are openings formed on a pair of inner wall parts arranged on the left and right of the front frame 250H. When the manual feed tray 5 is closed with respect to the housing 200, the projections 51B of the aforementioned hooks 51 are inserted axially outward (leftward in FIG. 11) into the openings 257. The contact portion 255 defines a part of the opening 257 and the projection 51B is engageable therewith. In this embodiment, the contact portion 255 defines a front side of the opening 257 and can come into contact with the first slant 511 of the projection 51B. The contact portion 255 is a wall surface which is a part of the front frame 250H and extends in the front-back direction on the front side of the opening 257. Note that although the periphery of the left hook 51 of the manual feed tray 5 is shown in FIG. 11, the vicinity of the right hook 51 of the manual feed tray 5 also has a similar structure.

As described above, in this embodiment, the manual feed tray 5 is capable of making a slight sliding movement in the lateral direction in the closed state of the manual feed tray 5

with respect to the housing **200**. The manual feed tray **5** is characterized in that the engaged positions of the projections **51**B with the contact portions **255** are variable in the axial direction (lateral direction) according to the sliding movement.

As shown in FIGS. **10**A and **10**B, the projections **51**B are engaged with the contact portions **255** at a first position P**1** (FIG. **11**) in the closed state of the manual feed tray **5** where the pair of projections **51**B are respectively engaged with the pair of contact portions **255**. Note that, according to a closing movement of the manual feed tray **5**, the top portions **513** come into contact with the contact portions **255** and are guided to the openings **257** while the projections **51**B are curved rightward. At the first position P**1**, the top portion **513** between the first and second slants **511**, **512** is inserted into the opening **257** and the contact portion **255** comes into contact with the first slant **511**, whereby the projection **51**B is fixed to the fixing portion **25**L. The contact portion **255** is in contact with a substantially central part of the first slant **511**. Further, the hook **51** is similarly fixed to the fixing portion **25**L on an opposite side of the manual feed tray **5** not shown in FIG. **11**.

On the other hand, the manual feed tray **5** may be closed in a one-sided closed state where the projection **51**B of one of the pair of hooks **51** (projection **51**B of the left hook **51** in FIG. **12**) is engaged with the contact portion **255** and the other projection **51**B (projection **51**B of the right hook **51** in FIG. **12**) is not engaged. Particularly, the use frequency of the manual feed tray **5** is relatively lower than that of the cassette **110** (FIGS. **1** and **2**) in the case of the manual feed tray **5** on which the hooks **51** are arranged as in this embodiment. Thus, the manual feed tray **5** may be left for a long time in the one-sided closed state. In this case, if a biased load is applied to the manual feed tray **5** for a long time, the base end portion **51**A of the hook **51** may be plastically deformed, thereby hindering proper fixing of the manual feed tray **5** thereafter.

In this embodiment, to solve the above problem, a load acting on the hook **51** is reduced even if the manual feed tray **5** is in the one-sided closed state. Specifically, in this embodiment, the projection **51**B of the left hook **51** is engaged with the contact portion **255** at a second position P**2** (FIG. **13**) in the one-sided closed state shown in FIG. **12**. At the second position P**2**, the top portion **513** is further inserted into the opening **257** than at the first position P**1**. Specifically, when the left hook **51** is attached to the fixing portion **25**L by a user, the projection **51**B is fixed in a state further inserted into the opening **257** than at the first position P**1** that is an original fixed position. At this second position P**2**, the top portion **513** is inserted deeper into the opening **257** than at the first position P**1** and the contact portion **255** is in contact with a side of the first slant **511** closer to the base end portion **51**A than at the first position P**1**, whereby the hook **51** is fixed to the fixing portion **25**L.

The manual feed tray **5** is made slidable in the lateral direction as described above to enable the manual feed tray **5** to be fixed in a state where the projection **51**B is moved more laterally outward than at the original fixed position (first position P**1**). Specifically, in the one-sided closed state shown in FIG. **12**, the manual feed tray **5** is slightly moved to the left as compared with the proper closed state shown in FIGS. **10**A and **10**B. Thus, with reference to FIG. **14**, the right hook **51** is stationary at a position to the left (arrow D**16** of FIG. **14**) of the position thereof when the manual feed tray **5** cannot slide. Thus, even if the manual feed tray **5** is left in the one-sided closed state for a long time, the top portion **513** of the right hook **51** (FIG. **14**) is not strongly pressed by the contact portion **255** and the plastic deformation of the base end portion **51**A of the hook **51** is prevented.

As described above, according to this embodiment, the manual feed tray **5** is slidable in the axial direction in the closed state of the manual feed tray **5**. The engaged positions of the projections **51**B with the contact portions **255** in the axial direction are changeable according to the sliding movement. As a result, the action of an excessive load on the hooks **51** is prevented by the sliding movement of the manual feed tray **5** also when the hooks **51** are fixed to the fixing portions **25**L in an inclined state or in the one-sided closed state where one hook **51** is not fixed to the fixing portion **25**L. Thus, the plastic deformation of the hooks **51** is prevented. Particularly, in the one-sided closed state of the manual feed tray **5**, the projection **51**B of one hook **51** is engaged with the contact portion **255** while being inserted more into the opening **257** than in normal time. Thus, the other hook **51** is moved away from the fixing portion **25**L in the axial direction. Thus, the action of an excessive load on the other hook **51** is suppressed.

Further, a resin material can be used for the hooks **51** since the plastic deformation of the hooks **51** of the manual feed tray **5** is prevented in this way. In other words, it is not necessary to use a metal material for main parts of the hooks **51** and the cost of the hooks **51** is reduced. Further, the tray main body **50** and the hooks **51** can be integrally molded by resin molding and the manufacturing cost of the manual feed tray **5** can be reduced.

Furthermore, in this embodiment, the position of the manual feed tray **5** in the axial direction is restricted in the open state of the manual feed tray **5** where a sheet S is placed on the upper surface of the manual feed tray **5**. Thus, the position of the placed sheet S is stably maintained. As a result, the sheet S is stably carried into the housing **200** to prevent a variation of the position of an image formed on the sheet S. Further, it is suppressed that the sheet S is carried into in an inclined state, thereby preventing a sheet jam. Furthermore, the manual feed tray **5** is stably rotated by the supporting shaft portions **6** and the bearing portions **53**. Further, the sliding movement of the manual feed tray **5** in the closed state and restriction on the axial position of the manual feed tray **5** in the open state are realized by the engaging projections **61** of the supporting shaft portions **6** and the engaging holes **531** of the bearing portions **53**.

Although the printer **100** (image forming apparatus) according to the embodiment of the present disclosure is described above, the present disclosure is not limited to this. For example, the following modifications may be adopted.

(1) Although the hook **51** of the manual feed tray **5** has two inclined surfaces, i.e. the first and second slants **511**, **512** in the above embodiment, the present disclosure is not limited to this. The hook **51** may have one inclined surface, e.g. the first slant **511** or may have another curved surface.

(2) Although the engaging holes **531** are arranged on the manual feed tray **5** and the engaging projections **61** are arranged on the housing **200** in the above embodiment, the present disclosure is not limited to this. The engaging projections **61** may be arranged on the manual feed tray **5** and the engaging holes **531** may be arranged on the housing **200**. Further, the manual feed tray **5** is not limited to such a mode as to be attached to the supporting shaft portions **6** of the housing **200** via the spaces between the first members **53**A and the second members **53**B. After the second members **53**B are fitted to the shaft portions **60** of the supporting shaft portions **6**, the first members **53**A may be fastened to the manual feed tray **5** such as by screws.

Although the present disclosure has been fully described by way of example with reference to the accompanying draw-

ings, it is to be understood that various changes and modifications will be apparent to those skilled in the art. Therefore, unless otherwise such changes and modifications depart from the scope of the present disclosure hereinafter defined, they should be construed as being included therein.

The invention claimed is:

**1**. An image forming apparatus, comprising:

an apparatus main body;

an image forming unit arranged in the apparatus main body and configured to forms an image on a sheet;

a tray unit that includes a pivot portion on a lower end part and is openable with respect to the apparatus main body by being rotated about the pivot portion, the tray unit having an upper surface on which the sheet is placed in an open state of the tray unit with respect to the apparatus main body and that is capable of making a sliding movement in an axial direction of the pivot portion in a closed state with respect to the apparatus main body,

the tray unit including first and second hooks projecting toward the apparatus main body respectively from opposite first and second end parts in the axial direction, each of the hooks having a base end portion projecting in a closing direction in which the tray unit is closed with respect to the apparatus main body and a projection projecting toward an axially outer side on a tip part of the base end portion in a direction parallel to the axial direction; and

an attaching portion arranged on the apparatus main body and to which the tray unit is attached in the closed state, the attaching portion including:

a facing plate standing to face the tray unit;

first and second fixing portions projecting from respective first and second axial ends of the facing plate in an opening direction in which the tray unit is opened, the fixing portions being opposed to each other in the axial direction;

first and second openings disposed respectively on the first and second fixing portions, the first and second projections being inserted respectively into the first and second openings toward the axially outer sides; and

first and second engaging portions that define parts of the respective first and second openings and with which the respective first and second projections are engaged, and

engaged positions of the first and second projections with the respective first and second engaging portions in the axial direction are variable according to the sliding movement in the axial direction in the closed state of the tray unit.

**2**. An image forming apparatus according to claim **1**, wherein:

the first and second projections are engaged respectively with the first and second engaging portions at a first position in the closed state of the tray unit where the projections of the respective hooks are engaged respectively with the engaging portions, and

the first projection is engaged with the first engaging portion at a second position where the first projection is inserted more into the first opening than at the first position in a one-sided closed state of the tray unit where the first projection is engaged with the first engaging portion and the second projection is not engaged with the second engaging portion.

**3**. An image forming apparatus according to claim **2**, wherein:

each of the first and second projections includes:

a top portion projecting from the base end portion toward the opening;

a first slant arranged on a rear end side in an closing direction of the tray unit toward the apparatus main body and inclined from the respective base end portion toward the respective top portion; and

a second slant arranged on a lead end side in the closing direction and inclined from the top portion toward the base end portion,

each of the first and second engaging portions defines a rear end side of the opening in the closing direction and is capable of coming into contact with the first slant of the respective projection,

the top portions of the first and second projections are inserted respectively into the first and second openings and the first and second engaging portion comes into contact with the respective first slants at the first position, whereby the projections are engaged respectively with the engaging portions, and

at the second position, the top portion of the first projection is inserted more into the first opening than at the first position and the first engaging portion comes into contact with a side of the first slant of the first projection closer to the base end portion than at the first position so that the first projection is engaged with the engaging portion.

**4**. An image forming apparatus according to claim **1**, further comprising:

a restricting portion for restricting the position of the tray unit in the axial direction in the open state with respect to the apparatus main body.

**5**. An image forming apparatus according to claim **4**, wherein:

the attaching portion includes a shaft portion extending along the axial direction and serving as a rotary shaft in the rotation of the tray unit,

the pivot portion is a bearing portion to be externally fitted on the shaft portion,

the restricting portion includes:

an engaging projection projecting from the shaft portion; and

an engaging hole in the form of an elongated hole open on the bearing portion along a circumferential direction of the rotation of the tray unit and into which the engaging projection is inserted,

an opening width of one circumferential end side of the engaging hole in the axial direction is set wider than the width of the engaging projection in the axial direction and an opening width of the other circumferential end side of the engaging hole in the axial direction is set substantially equal to the width of the engaging projection in the axial direction,

the engaging hole is movable in the circumferential direction with respect to the engaging projection as the tray unit is opened and closed with respect to the apparatus main body, and

the tray unit is made slidable in the closed state by forming a clearance in the axial direction between the one end side of the engaging hole and the engaging projection and the position of the tray unit in the axial direction is restricted in the open state by fitting the engaging portion into the other end side of the engaging hole.

**6**. An image forming apparatus according to claim **5**, wherein:

the bearing portion includes:

a first member on which the engaging hole is open and which supports a circumferential part of the shaft portion; and

a pair of second members which are arranged at opposite sides of the first member in the axial direction and support circumferential parts of the shaft portion, and

an open area between the first and second members is partly open along the circumferential direction in a cross-section intersecting with the axial direction and the shaft portion is attached between the first member and the second members via the open area, whereby the shaft portion is rotatably supported on the first and second members.

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